



Graduate Handbook

For

Master's & Ph.D. Students

UAHuntsville

Mechanical & Aerospace
Technology Hall N274
Huntsville, AL 35899
256-824-6154

Chemical & Materials
Engineering Building 130
Huntsville, AL 35899
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Rev.(10/2008)

UA Huntsville

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE



- 1. North Campus Residence Hall
- 2. Frank Porter Hall
- 3. Moore Hall
- 4. Union Grove Gallery & Meeting Hall
- 5. Spragins Hall
- 6. Roberts Hall
- 7. University Center Administration
- 7a. Erdahl Hall
- 8. Central Campus Residence Hall
- 9. Small Center
- 10. Nursing Building
- 11. Science Library
- 12. Amphitheater
- 13. Wilson Hall
- 14. Business Administration Building
- 14a. O'Connell Auditorium
- 15. University Fitness Center
- 15a. Intramural Parking Facility
- 16. Public Safety
- 17. Shelby Center for Science & Technology
- 18. Popularity-Security Area
- 19. Student-Campus Housing
- 20. Credit Union

- 21. Madison Hall
- 22. Robert "Bob" Crayton Research Hall
- 23. National Space Science & Technology Center & NASA Teacher Perseus Office
- 24. Alvin R. Field Complex
- 24. Olin Building
- 25. Molecular Science Building
- 26. Engineering Building
- 27. Solar Energy Research
- 28. Wendover van Brunt Research Hall
- 29. Physical Plant
- 30. Central Processing & Shipping
- 31. Johnson Research Center
- 32. Propulsion Research Lab
- 33. MUM Public Station
- 34. Business Services Building
- 35. Double Ring Hall
- 36. Olin E. Rigg Technology Hall

**MAE Dept. in
Technology Hall
N274**

MESSAGE FROM THE FACULTY

Dear Graduate Student:

Welcome to the Department of Mechanical and Aerospace Engineering at The University of Alabama in Huntsville. We are delighted that you have elected to further your engineering education at UAHuntsville. We hope that your experience with us will be fulfilling, rewarding, and productive. We have an excellent department with a range of opportunities for you to explore. The range of research interests of our faculty is quite broad, affording our graduate students opportunities for advanced work in the major areas of fluid and solid mechanics, heat transfer, aerodynamics, thermodynamics, transport phenomena, applied optics, experimental mechanics, uncertainty techniques, space plasma, controls, combustion, and propulsion, among other areas. We also offer specialized programs leading to a MSE in Rotorcraft or Missiles Systems Engineering. We encourage you to explore the depth and breadth of the area that best fits your professional ambitions. The MSE and Ph.D. degrees granted by the Department in these areas are equivalent to those available from Mechanical and Aerospace Engineering Programs across the country. Please note that the Ph.D. degree in Chemical Engineering is also administered through the Department of Mechanical and Aerospace Engineering.

We encourage you to seek out the faculty of the Department and learn more about our research activities and areas of specialization. Further, we invite you to see the members of the Graduate Program Committee or the Department Chair whenever you need assistance in your graduate studies. This Handbook is provided to give you more information about the Department, its regulations, and its procedures. This Handbook serves as a supplement to the most current Graduate Catalog of the University. The information contained in this Handbook in no way supersedes the official general rules and regulations of the Department or the School of Graduate Studies.

We look forward to meeting you. We wish you the best in your academic endeavors.

Sincerely,

The Graduate Faculty

Mechanical & Aerospace Engineering

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GRADUATE FACULTY

MECHANICAL & AEROSPACE ENGINEERING FACULTY

DAWN BARDOT, Assistant Professor, Ph.D. - University of Washington. Areas of research interest include computational and experimental methods in thermal/fluid science and biomedical engineering with emphasis on simulation validation and virtual prototyping. Office: TH N264, (256) 824-2022. Email: dawn.bardot@uah.edu

JAMES B. BLACKMON, Research Professor, Ph.D. - University of California-Los Angeles. Research interests include propulsion systems, solar power systems, and space hardware development. Office: TH S233, (256) 824-5106. Email: blackmoj@uah.edu

JASON CASSIBRY, Assistant Professor, Ph.D. - University of Alabama in Huntsville. Research involves theoretical and experimental studies of plasma acceleration and magnetized target fusion for advanced propulsion concepts and terrestrial power production. Specific topics include pulsed electromagnetic plasma thrusters, MHD modeling, and smoothed particle hydrodynamics. Office: TH N260, (256) 824-5107. Email: cassibj@uah.edu.

T. J. CHUNG, UA System Distinguished Professor, Ph.D. - Oklahoma State University. The author of several books including *Computational Fluid Dynamics*, Cambridge University Press, 2002. Current research includes turbulence, combustion, acoustics, radiative heat transfer, multiphase flow, relativistic astrophysical flows. Office: TH N272C, (256) 824-6394. Email: tchung@mae.uah.edu

HUGH W. COLEMAN, Professor, P.E., Ph.D. - Stanford University. Current research includes propulsion, verification and validation of models, experimentation and uncertainty analysis. Co-author (with W. Glenn Steele, Jr.) of the book *Experimentation and Uncertainty Analysis for Engineers*, 2nd ed., John Wiley and Sons, 1999. Office: TH N267, (256) 824-5083. Email: coleman@mae.uah.edu

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ROBERT A. FREDERICK, Associate Professor and Director of the Propulsion Research Center, Ph.D. - Purdue University. Areas of interest include solid, liquid, and hybrid propulsion, combustion instability missile design, and multi-disciplinary design. Office: TH S226, (256) 824-7200. Email: frederic@mae.uah.edu

KADER FRENDI, Professor and Department Chair, Ph.D. – Brown University. Areas of research interest include applied computational fluid dynamics, numerical analysis, chemically reacting flows, acoustics, fluid-structure-acoustic interactions, supersonic and hypersonic laminar, transitional and turbulent flows. Office: TH N274, (256) 824-6154. Email: frendi@mae.uah.edu

JOHN A. GILBERT, Professor, Ph.D. - Illinois Institute of Technology. Specializes in experimental stress analysis and applied optics with principal expertise concentrated in the areas of fiber optic sensing, holographic interferometry, speckle metrology, panoramic imaging, & strategically turned absolutely resilient structures. Office: OB 301E (256) 824-6029. Email: jag@eng.uah.edu

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MARLOW D. MOSER, Associate Professor, Ph.D. - The Pennsylvania State University. Areas of interest include solid and liquid rocket combustion, combustion instability, atomization of sprays, mixing, and laser diagnostics. Office: TH S232, (256) 824-7201. Email: moser@mae.uah.edu

GEORGIA RICHARDSON, Assistant Professor, Ph.D. - University of Alabama in Huntsville. Areas of interest include computational fluid dynamics, numerical method development, magneto-hydrodynamics, plasma dynamics and design of thermal systems. Office: TH N269, (256) 824-6209. Email: georgia.richardson@uah.edu

BABAK SHOTORBAN, Assistant Professor, Ph.D. - University of Illinois at Chicago. Areas of interest include multiphase flows, turbulence, computational fluid dynamics, stochastic and probabilistic modeling of thermo-fluid flows, propulsion and high performance computing. Office: TH N261, (256)824-2821. Email: shotorb@mae.uah.edu

NATHAN SLEGGERS, Assistant Professor, Ph.D. – Oregon State University. Areas of interest include modeling dynamic behavior and developing unique control mechanisms for mechanical and aeronautical devices and optimization of control methods with application to micro air vehicles and unmanned air vehicles. Office: TH N266, (256)824-6543. Email: sleggers@mae.uah.edu

JAMES SNIDER, Research Professor, Associate Vice President for Research and Director of the Rotorcraft Systems Engineering and Simulation Center, Ph.D. - Naval Postgraduate School. Research interests in rotorcraft systems including condition based maintenance. Office: VBRH M17, (256) 824-6066. Email: jsnider@eng.uah.edu

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FRANCIS WESSLING, Professor, P.E. Ph.D. - University of Minnesota. Past research in materials in a microgravity environment, including designing several experiments for flight on the Space Transportation System (Space Shuttle, STS) and on the International Space Station, ISS. Research publications in the areas of heat transfer, rocketry and energy conservation. Office: TH N270, (256) 824-5020. Email: wesslif@uah.edu

S. T. WU, UA System Distinguished Professor Emeritus, Ph.D. - University of Colorado. Research in magnetohydrodynamics, gasdynamics, radiative gasdynamics, plasmadynamics, and computational methods in fluids and heat transfer with applications to understanding various solar phenomena including solar flares, the solar wind and space environment. Research is funded by NASA, DOD, NSF. Office: TH N272B, (256) 824-6413. Email: wus@cspar.uah.edu.

KEN ZUO, Associate Professor, Ph.D. – University of New Mexico. Areas of research interest include physics-based constitutive models for the response of materials and structures under both static and high-rate loadings. Office: TH N258, (256) 824-6893. Email: zuo@mae.uah.edu

CHEMICAL & MATERIALS ENGINEERING FACULTY

R. MICHAEL BANISH, Professor, Ph.D. – University of Utah. Areas of research interest include crystal growth, low gravity processes, phase diagrams, and thermophysical property measurements (heat and mass transfer). Office: EB 132, (256) 824-6969. Email: banishm@uah.edu

RAMON L. CERRO, Professor and Department Chairman, P.E., Ph.D. - University of California at Davis. Areas of research interest include physicochemical hydrodynamics, heat and mass transfer in multiphase systems, and monomolecular Langmuir-Blodgett ultra thin films (nanotechnology). Research funded by NSF. Office: EB 131, (256) 824-7313. Email: rlc@che.uah.edu

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KRISHNAN K. CHITTUR, Professor, Ph.D. – Rice University. Areas of research include blood materials interactions through infrared spectroscopic (FT-IR/ATR) techniques, protein-surface interactions and bioinformatics. Research funded by NIH. Office: EB 121, (256) 824-6850, Email: kchittur@eb.uah.edu

JAMES E. SMITH, JR., Professor, Ph.D. – University of South Carolina. Areas of research include catalysis, energy conversion, materials processing in space, surface chemistry, advanced furnace design and analysis, fiber optic chemical sensing, and hypergolic bipropellant combustion. Research funded by SMDC and Corporations. Office: EB 138, (256) 824-6439, Email: jesmith@che.uah.edu

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DAVID B. WILLIAMS, Professor and UAHuntsville President, Ph.D., Sc.D. - Cambridge University. Research interests include analytical/transmission and scanning electron microscopy (X-ray microanalysis, electron energy-loss spectrometry and convergent-beam electron diffraction); applications to interfacial segregation and bonding changes, texture and phase-diagram determination in metals and alloys for aerospace and power-generation; structure determination in glasses. Office: SKH 370, (256) 824-6340. Email: David.Williams@uah.edu

GENERAL INFORMATION

GRADUATE DEGREE PROGRAMS

The range of faculty research interests in the Department of Mechanical and Aerospace Engineering (MAE) is broad. This offers graduate students opportunities for advanced work in areas such as fluid and solid mechanics, heat transfer, acoustics, aerodynamics, thermodynamics, transport phenomena, propulsion, combustion, computational fluid dynamics and mechanics, experimental mechanics, dynamics and controls, and rotorcraft or missiles systems. Interested individuals are encouraged to review the information about faculty research interests, ongoing research projects, program requirements, course availability, funding opportunities, and forms available on the MAE web site at www.mae.uah.edu. Prospective and current students should note that the most current version of the MAE Graduate Handbook is posted on the web site.

The MAE Department offers a variety of programs leading to the Master of Science in Engineering (MSE) degree with options in Aerospace Engineering or Mechanical Engineering. The Department also offers specialized programs leading to Aerospace MSE degrees in Rotorcraft or Missiles Systems Engineering. MAE faculty are well known for their scholarly and research activities. The Department offers a research-oriented program leading to the Doctor of Philosophy (Ph.D.) degree in Mechanical Engineering. A Program of Study leading to a Ph.D. degree in Chemical Engineering is also administered by the MAE Department.

GRADUATE PROGRAM COMMITTEE

The Department Chair is responsible for the administration of the MAE Department's graduate program. The Chair is aided by the Graduate Program Committee that has the responsibility of evaluating new applications, recommending graduate students for financial assistantships, and coordinating and supervising graduate exams. Additional responsibilities include the evaluation of graduate regulations, courses, and programs of study.

FINANCIAL AID AND ASSISTANTSHIPS

The MAE Department has at its disposal a number of appointments for teaching assistants and research assistants supported by department funds.

Teaching Assistants (TA) are appointed and supervised by the Department Chair. They normally aid professors in large courses by handling laboratory and discussion sections, and grading papers.

Research Assistants (RA) are appointed by the individual department professors to help them in their specific research activities. Their continued appointment from one semester to the next is dependent on the availability of research funds.

All appointments include a stipend, tuition and a modest health insurance policy. Graduate student assistants are expected to perform 20 hours of work per week. Any deviation from this rule must be approved by the Department Chair.

Students holding a teaching or research assistantship must register for at least nine (9) credit hours in each Fall and Spring semester and six (6) credit hours in each Summer semester. Graduate assistants must also register for ten (10) credit hours during the semester they enroll in Graduate Seminar (MAE 683).

The Graduate Program Committee continuously reviews the record and progress of every graduate student. All teaching and research appointments are conditional on satisfactory academic and teaching/research performance.

APPLICATION PROCEDURE

An applicant for the Master of Science in Engineering (MSE) or Doctor of Philosophy (Ph.D.) degree programs must submit a completed graduate application form (see **FORMS**) and a nonrefundable application fee to the Office of Graduate Admissions. The general application directions are provided in the UAHuntsville Graduate Catalog. Applicants for degree admission must submit complete transcripts from all colleges and universities attended. Applicants for non-degree admission must provide proof of a bachelor's degree from an accredited institution and obtain department approval.

The GRE exam is required for all students. However this requirement may be waived by the Graduate Dean upon recommendation of the Department Chair if at least one of the following conditions holds:

- (a) The applicant holds a post-baccalaureate degree from an accredited institution;
- (b) The applicant presents evidence of having taken the GRE over 5 years ago and hence cannot obtain official scores; or
- (c) The applicant graduated with an engineering degree from an accredited college or university five or more years ago, has not subsequently been enrolled since that time, and has a record of consistent and continuous professional and/or academic achievement as documented on a submitted resume.

In addition to the GRE, international students are required to take the TOEFL exam. Required scores are provided in the UAHuntsville Graduate Catalog.

To assure adequate time for review, applications should be received by June 15 for Fall semester admission, October 15 for the Spring semester, and March 15 for the Summer semester. Applications submitted after this date may not be processed in time for admission in the following semester. Applicants desiring a teaching or research assistantship are especially encouraged to submit before these dates.

ADMISSION REQUIREMENTS

The Department reviews each individual applicant based on multiple factors including, but not limited to: grades, grade point average, prior academic experience, references, independent and supervised research, and test scores. All decisions reflect these cumulative and multifaceted criteria and no one factor is determinative. Minimal GPA and test scores do not guarantee admission since applicants are judged on their overall qualifications.

For unconditional admission to the MSE degree program, applicants must have an engineering baccalaureate from an accredited college or university, a grade point average of at least 3.00 (where A = 4.00) for the final 60 semester hours of undergraduate study, and may submit up to three letters of recommendation. Generally, a GRE score of 1600 is required for unconditional admission. The score on the verbal section of the GRE and the TOEFL exam are specifically considered for international student applicants. In exceptional cases, applicants with grade point averages below 3.00 and/or GRE scores below 1600 may be admitted on conditional standing if they show evidence of substantial ability to successfully complete their degree program. See the UAHuntsville Graduate Catalog for the policies on conditional admission.

Applicants with outstanding records in fields other than mechanical or aerospace engineering, or from a non-accredited engineering program will be considered for conditional admission, and must remedy deficiencies in their preparation after the start of their academic program. This remedy may include taking prerequisite undergraduate MAE courses as described in **PROGRAM OF STUDY REQUIREMENTS FOR STUDENTS WITHOUT A BS DEGREE IN MECHANICAL OR AEROSPACE ENGINEERING**. After satisfying these requirements a student may then be granted unconditional standing in the graduate program.

Applicants to the Ph.D. program are also evaluated on the basis of their overall records. A minimum graduate grade point average of 3.00 is required before an application will be processed. The MAE Ph.D. is a research-oriented degree. A record of substantial research experience, such as the completion of a Master's thesis, is an important factor in consideration for admission.

After initial review for admission by the Graduate Program Committee, each applicant that meets the above requirements will be asked to fill out the MAE Graduate Student Information form (see **FORMS**) and electronically return it to the MAE Department. This form is used for initial advisor assignment and consideration for an assistantship.

Additional details related to Provisional and Non-degree admission are provided in the UAHuntsville Graduate Catalog. All decisions regarding admission to graduate study in a degree program are discretionary and are determined solely by the MAE Graduate Program Committee and Department Chair with the approval of the Dean of the School of Graduate Studies.

TRANSFER CREDIT

The policies governing transfer of course credits are described in the section on MSE Degree Requirements and Ph.D. Degree requirements. Graduate students who wish to transfer course credits earned at other universities or to request a waiver of some of the degree requirements should contact the MAE Department Chair, the Graduate Program Committee, or his/her advisor immediately upon arrival at UAHuntsville for early appropriate action.

ADVISING

Upon admission to the graduate program, a student is assigned a temporary faculty advisor by the Department Chair. This assignment is made on the basis of the student's intended fields of concentration or special interests. The temporary advisor will assist the student during the first

two terms of registration and acquaint the student with the various rules, regulations and procedures of the Department. A MSE student is required to select a permanent advisor no later than the end of the semester in which he/she will have accumulated 12 credit hours. A Ph.D. student must select a permanent advisor immediately after passing the Preliminary Examination. In the semester immediately following selection by the student, the permanent advisor must establish a Supervisory Committee to review the student's program of study. If their research interests so dictate, a student in the MAE Department may select an advisor from the Chemical Engineering Department.

The MAE faculty will be glad to meet all graduate students and discuss their research interests. However, an advisor may indicate at any time that he/she no longer wishes to retain the student under his/her supervision. Should the advisor decide not to retain the student, the advisor must inform the student and the Department Chair in writing. Should the student desire to end the association, the student must similarly inform the advisor and the Department Chair. If the student is in good standing, the Graduate Program Committee in consultation with the Department Chair will assist the student in selection of a new advisor. Students on teaching or research assistantships may be required to continue under their current advisor until the end of a semester.

CONTINUATION

Students may continue to register as long as they remain in good standing, here defined as satisfactory progress and achievement, and meet the code of conduct described in the Student Handbook. The Graduate School specifies that a student must maintain a cumulative grade point average of at least 3.0 on all work taken at UAHuntsville as a graduate student.

REPETITION OF COURSES

A student is permitted to repeat a course for credit in the following two situations:

- (1) The course is designated in the UAHuntsville semester schedule or catalog with the phrase "May be repeated for credit"; or
- (2) A grade of C or lower was received in the course.

In the latter case, the course may be repeated only once and may be counted only once toward the degree requirements. The original grade will continue to be included in the computation of the student's grade point average. Approval of both the instructor of the course and the Department Chair is required for course repetition.

GRADUATE SEMINAR POLICY

Except for those students in the specialized Rotorcraft or Missile Systems Engineering MSE programs, all other MSE and Ph.D. program students are required to take MAE 683 – Graduate Seminar. The Graduate Catalog course description is as follows:

MAE 683 Graduate Seminar

(1 hr)

Professional activities designed to promote the skills required to organize and deliver oral technical presentations and to broaden the individual's awareness of technical issues. Students will be graded "S" (satisfactory) or "U" (unsatisfactory) based upon their performance and attendance. Students who do not receive an "S" grade must register for the course until an "S" is obtained.

The purpose of this course is primarily to provide opportunities for students to prepare and practice making presentations. The topic for the presentation may be selected by the student but it shall be technical in nature; preferably, related to: (1) thesis/dissertation research; or (2) other work related activities. Satisfactory completion of the Graduate Seminar requires the student to make an acceptable presentation **and** fulfill all other attendance and course requirements.

To enroll in MAE 683, Plan I MSE students and Ph.D. candidates must have completed or be concurrently enrolled in MAE 699 or MAE 799, respectively. Plan II Non-thesis MSE students must have completed 24 hours of graduate course work or be in their last semester of study in the MSE program.

DISTANCE LEARNING

A number of MAE courses are provided using state-of-the-art distance learning technology. Courses in the Rotorcraft and Missile Systems Engineering programs can all be taken online. For more details, please see the Distance Learning site at <http://www.engdl.uah.edu/b/index.php>.

PROGRAM OF STUDY REQUIREMENTS FOR STUDENTS WITHOUT A BS DEGREE IN MECHANICAL OR AEROSPACE ENGINEERING

All students who are admitted to the MAE MSE or Ph.D. programs must first contact the Department Chairman or chair of the Graduate Program Committee for assignment of a temporary advisor prior to registration. Students with a BS or BA degree in disciplines other than Mechanical or Aerospace Engineering may be admitted to the MAE MSE or Ph.D. programs if the student:

- (1) Is judged by the Graduate Program Committee to be capable of pursuing MAE graduate courses with grades of B or above, **AND EITHER**
- (2) Takes a total of 30 semester hours of MAE undergraduate courses from the following list:

| | |
|---------|--|
| MAE 272 | Dynamics |
| MAE 310 | Fluid Dynamics I |
| MAE 341 | Thermodynamics I |
| MAE 342 | Thermodynamics II |
| MAE 364 | Kinematics and Dynamics of Machines |
| MAE 370 | Mechanics of Materials |
| MAE 385 | Numerical Methods and Engineering Computations |
| MAE 410 | Fluid Dynamics II |
| MAE 420 | Compressible Aerodynamics |
| MAE 450 | Heat & Mass Transfer |
| MAE 488 | Analysis of Engineering Systems |

OR

- (3) Submits a proposal, in consultation with his/her advisor, to the Graduate Program Committee for waiver of one or more, or all courses listed in item (2) above. This proposal must be accompanied by well-documented justifications. A proposed graduate Program of Study (see **FORMS**) should accompany the proposal. Consideration will be given to the student's chosen areas of interest, work experience, and previous educational record. The Graduate Program Committee will determine the acceptability of this proposal. Approval requires a majority vote of the Committee.

Documentation listing undergraduate course work requirements approved by the advisor, Graduate Program Committee, and the Department Chair must be included in the student's permanent file.

MASTER OF SCIENCE IN ENGINEERING DEGREE REQUIREMENTS

The MAE Department offers three options leading to the degree of Master of Science in Engineering (MSE). These are designated: Plan I (Thesis), Plan II (Non-thesis) and Plan II SE. The following sections describe the requirements for each of these options. These requirements are also summarized in Table 1.

Table 1 – MSE Program Option Requirements

| Option | Course Hours | Research Hours | Other | Exam |
|------------------------------------|---|---------------------|-------------------|--|
| Plan I, Thesis (34 hrs) | 24, including MAE 692 and 671 | 9 hrs of MAE 699 | MAE 683 (1 hr) | Thesis Defense |
| Plan II, Non-thesis (34 hrs) | 33, including MAE 692 and 671 | ----- | MAE 683 (1 hr) | Comprehensive Exam: Technical presentation in MAE 683* |
| Plan II SE (36 hrs) | 36 See Rotorcraft and Missile SE Curriculums | ----- | MAE 684 (0 hr) | Comprehensive Exam: Satisfactory performance** in MAE 631/632 or MAE 633/634 |

*See **GRADUATE SEMINAR POLICY**

**Satisfactory performance is demonstrated by a grade of B or better.

BASIC MSE PROGRAM OF STUDY

The Basic Program of Study, common to both the Plan I and Plan II (Non-thesis) MSE options, contains a minimum of 24 hours of graduate-level course work that must include:

- (a) An engineering major consisting of 12 hours of graduate courses including supporting engineering courses;
- (b) A first minor of 6 hours of graduate courses in an approved engineering area of specialization; and
- (c) A second 6 hour minor consisting of MAE 692 and an additional 3 hour graduate course in Mathematics or Graduate Engineering Analysis. The required MAE 671 course may be used to fulfill this additional 3 hours.

With prior approval, up to 12 hours of 500 level courses may be taken in fulfillment of the Basic and Specific program requirements.

SPECIFIC MSE PROGRAM REQUIREMENTS

Plan I, Thesis Option (34 hours). Students selecting this option must:

- (a) Successfully complete an approved Basic Program of Study consisting of 24 course hours including MAE 671;
- (b) Successfully complete the 1 hour Graduate Seminar (see **GRADUATE SEMINAR POLICY**);
- (c) Successfully complete at least 9 semester hours of MAE 699 – Master’s Thesis; and
- (d) Complete an acceptable thesis and pass the final examination consisting of a public thesis defense.

Plan II, Non-thesis Option (34 hours). Students selecting this option must:

- (a) Successfully complete an approved Basic Program of Study consisting of 24 course hours including MAE 671;
- (b) Successfully complete an approved extended program of study consisting of an additional 9 hours of graduate courses; and
- (c) Successfully complete the 1 hour Graduate Seminar. This includes an oral technical presentation in MAE 683 which constitutes the Comprehensive Exam (see **GRADUATE SEMINAR POLICY**).

Plan II SE Option (36 hours). This option is for students pursuing a MSE degree in Rotorcraft Systems Engineering or Missile Systems Engineering. Students selecting this option must:

- (a) Successfully complete 36 semester hours of graduate course work specific to the SE curriculum;
- (b) Successfully complete the 0 credit hour MAE 684 – Aerospace Systems Seminar; and
- (c) Successfully complete the specified capstone design sequence (MAE 631/632 or MAE 633/634) with a grade of B or better. Completion of this capstone sequence constitutes the Comprehensive Exam.

GRADE REQUIREMENTS

All MSE students must maintain satisfactory academic standing to continue their degree program. Satisfactory standing includes the following:

- (1) Average grade on the courses numbered 600 and above cannot be less than B; and
- (2) A minimum grade of B must be attained in each engineering course in the student’s Program of Study designated by a number less than 600. If a lower grade is attained, a substitution of another approved course is required.

The following additional policies are applied to 500 level courses:

- (1) Engineering courses numbered between 500-599 may be taken for graduate credit with prior approval of such courses on the student’s Program of Study. Graduate students may be required to do extra work of appropriate nature in 500-level courses.
- (2) The number of 500 level course credit hours shall not exceed twelve (12).

TRANSFER CREDIT

With permission of the Graduate Program Committee and the Department Chair, a student may transfer a maximum of 6 semester hours of acceptable graduate credit earned in an approved institution and may count it toward a MSE degree. The student may also petition the MAE Department to recommend to the Graduate Dean that 6 additional hours of graduate credit be accepted. Such credit may not be more than ten years old at the time of the student's graduation from UAHuntsville. The credit is transferable only if the student (1) was enrolled in a graduate school at the time the courses were taken, and (2) had an overall average of B or better in graduate coursework at that institution.

Students who have graduate credit from another campus of the University of Alabama System must complete a minimum of 12 semester hours of acceptable graduate credit at UAHuntsville to receive an MSE degree from UAHuntsville. Additional rules governing transfer of credit are contained in the UAHuntsville Graduate Catalog.

MSE THESIS

The thesis should show evidence of the student's capability for research, independent thought, and analysis. Furthermore, the thesis should be written in fluent, acceptable English. The subject must be in the major field. All theses must be accessible to the general public. The thesis is supervised and approved by a faculty Supervisory Committee composed of at least three members of the graduate faculty and appointed by the Department Chair with approval of the Graduate Dean. Students working on a thesis must register for thesis credit (MAE 699) each term in which they receive supervision or during which they are engaged in the formal preparation and/or defense of the thesis.

A completed copy of the thesis must be submitted to the MAE Department at least eight weeks before the end of the semester in which degree requirements are expected to be completed. Detailed procedures for submission of theses can be found at <http://grad.uah.edu>. After the student has passed his/her thesis defense and at least five weeks before the end of the semester in which degree requirements are expected to be completed, a copy of the thesis signed by the Supervisory Committee, Department Chair and College Dean must be submitted to the Office of Graduate Studies for final proofreading and approval by the Graduate Dean. Six printed copies and one digital copy of the final approved thesis must be deposited in the Office of Graduate Studies along with applicable forms and fees one week prior to the end of the semester. Theses must comply with the regulations set forth in the Graduate School's *Thesis and Dissertation Manual*, available online at <http://grad.uah.edu/thesismanual.php>.

In exceptional cases, theses may be written in absentia. Before leaving the University, students must:

- (1) Select a thesis subject;
- (2) Submit a satisfactory outline of the thesis to the Department Chair; and
- (3) Submit evidence that adequate facilities are available where the research is to be done.

The student's advisor, the Department Chair, and the Graduate Dean must approve such a plan.

JOURNAL SUBMITTAL

Each Plan I student is required to derive a manuscript from their thesis for consideration for publication as a technical note or article in an appropriate refereed journal. The specific journal should be chosen in consultation with the advisor and Supervisory Committee. A draft of this manuscript must be submitted to the Supervisory Committee at the oral Final Examination and may be included as an appendix to the thesis. The final revised manuscript must be provided to the student's advisor when the final thesis manuscript is submitted. The manuscript must be appropriately formatted as specified by the journal editors.

SUPERVISORY COMMITTEE

Each Plan I MSE student must select a Supervisory Committee consisting of a Committee Chair, and at least two additional members. A majority of the committee must be from the MAE Department. The Chair and at least half of the Committee must:

- (1) Be full-time UAHuntsville faculty members; and
- (2) Have full membership in the graduate faculty.

The student's advisor typically chairs the Committee. The other two members are selected by the advisor in consultation with the student and are subject to approval by the Department Chair and the Graduate Dean. Under the guidance of the advisor, the Plan I student will be allowed to register for thesis credit (MAE 699). The Supervisory Committee must receive a complete copy of the thesis two weeks prior to the defense date. The final thesis must be approved by a majority of the Committee.

The Supervisory Committee for Plan II, Non-thesis students consists **ONLY** of the advisor who approves the program of study and final application for degree. The instructor of the student's Graduate Seminar must sign the Notification of Oral Examination (see **FORMS**) to confirm that the student successfully completed the required technical presentation in MAE 683 (see **GRADUATE SEMINAR REQUIREMENTS**). This technical presentation represents the student's Comprehensive Exam.

The Supervisory Committee for Plan II SE students consists of three members of the graduate faculty that are appointed by the Department Chair based on the recommendation of the Graduate Program Committee. The Committee members must attend the final presentation of the capstone Rotorcraft or Missile design course sequence (MAE 631/632 or MAE 633/634) and approve the student's presentation. This presentation represents the student's Comprehensive Exam.

CANDIDACY

A student admitted to the MSE Program is a candidate for the degree if he/she has met all admissions requirements, is not on probation, has an approved Program of Study on file in the Office of Admissions and Records, and has an average of B or better on all graduate work attempted at UAHuntsville.

FINAL EXAMINATION

For Plan I students, the Final Examination is an oral presentation of the thesis in the form of a seminar before the student's Supervisory Committee and is open to members of the University community. Approval of the thesis by a majority of the Committee is required. Students cannot schedule their final examination unless they are in good academic standing. Plan I students must also be enrolled in thesis hours (MAE 699) in the semester they defend and or graduate. The Supervisory Committee can also recommend a Ph.D. Preliminary Exam waiver for a Plan I student by approving the **Preliminary Exam Waiver** (see **FORMS**) at the Final Exam. This request for a waiver must be submitted to the Department Chair when the final thesis manuscript is submitted for review.

For Plan II, Non-thesis students, the Final or Comprehensive Examination consists of a technical presentation in MAE 683 (see **GRADUATE SEMINAR REQUIREMENTS**). For Plan II SE students the Final or Comprehensive Examination consists of an approved final presentation in the capstone Rotorcraft or Missile design course sequence (MAE 631/632 or MAE 633/634).

TIME LIMIT

All requirements for the MSE degree should be completed in not more than six years. Credit for individual graduate courses completed at UAHuntsville more than six years but less than ten years before the completion of all requirements for the degree may be validated by special examination. Such an examination, given by the department in which the course is offered, can be taken only once and will be the equivalent of a final exam. The form entitled **VALIDATION OF COURSES BEYOND THE SIX YEAR LIMIT** (see **FORMS**) must be submitted to confirm successful validation.

APPLICATION FOR DEGREE

Each MSE candidate must apply for the degree by submitting the appropriate form and fee through Charger Central at least three months before it is to be conferred. Consult the Graduate Studies website for specific deadline dates.

MSE DEGREE CHECKLIST

The checklist in Table 2 summarizes the steps to follow to ultimately attain a MSE degree in the MAE Department. Note the dates indicated and the forms to be filed. The individual forms show the required approvals and number of copies needed or specified by the Department and Graduate Studies. Students should also refer to the section entitled **MASTER'S AND Ph.D. STUDENTS DATES & DEADLINES** for important dates and deadlines designated by the Graduate School.

Table 2- MSE Degree Checklist

| Step | Date / Deadline | Forms |
|---|---|--|
| Submit Application to UAHuntsville Graduate Studies | June 15 – Fall; October 15 – Spring; March 15 – Summer | http://www.uah.edu/gradschool/admissions.php |
| Fill out MAE Graduate Student Information Form | Return to MAE Department as soon as possible. | MAE Department Graduate Student Information (see FORMS) |
| <ul style="list-style-type: none"> ➤ Select a permanent Advisor ➤ Form Supervisory Committee ➤ Submit a Plan of Study to the Graduate School | No later than the end of the semester in which student will have accumulated 12 credit hours. | Program of Study for Masters Degree http://www.uah.edu/gradschool/forms.php |
| <ul style="list-style-type: none"> ➤ Submit thesis proposal to Supervisory Committee for approval (Plan I). ➤ Identify journal for manuscript submittal (Plan I). | No later than the end of the semester in which student will have accumulated 24 credit hours. | |
| <ul style="list-style-type: none"> ➤ Verify Program of Study or petition for PoS Change ➤ Validate Courses Beyond Six Year Limit | At least one semester before Graduation. | Change to Program of Study http://www.uah.edu/gradschool/forms.php Validation of Courses Beyond The Six Year Limit (see FORMS) |
| Submit form to change Supervisory Committee membership (if needed) including valid reason for change. | At least one semester before Graduation. | Petition for Change in Graduate Supervisory Committee http://www.uah.edu/gradschool/forms.php |
| File Application for Advanced Degree | At least 3 months before Final Exam/Defense. | Application for Advanced Degree http://www.uah.edu/gradschool/forms.php |
| Present thesis research in a Graduate Seminar (Plan I) | <ul style="list-style-type: none"> ➤ Typically same semester of thesis oral examination. ➤ Must have completed or be concurrently enrolled in MAE 699. | |
| Schedule Final Oral Examination (Plan I) or Final Comprehensive Exam (Plan II SE). | <ul style="list-style-type: none"> ➤ At least two weeks in advance of Exam. ➤ Exam must be taken at least one month before graduation, and not earlier than the semester in which the student completes all required course work. | Notification of Oral Examination/Defense http://www.uah.edu/gradschool/forms.php |
| Prepare journal article manuscript in appropriate format. | <ul style="list-style-type: none"> ➤ Present draft manuscript to Supervisory Committee at oral thesis defense. ➤ Submit final manuscript with final thesis document. | |
| Make Final Comprehensive Exam technical presentation (Plan II, Non-thesis) in Graduate Seminar. | Semester after completing 24 hours of graduate course work or in last semester. | Certification of MSE Non-thesis Presentation (see FORMS) |

Table 2- MSE Degree Checklist, Continued

| Step | Date / Deadline | Forms |
|---|---|--|
| Advisor submits results of Final Oral Examination (Plan I, Plan II, and Plan II SE). | Final results must be reported to the Graduate School by approximately the tenth week of the semester in which the degree is expected. See Graduate School Calendar for date. | Report of Oral Examination Committee http://www.uah.edu/gradschool/forms.php |
| Based on Supervisory Committee approval, Advisor submits Ph.D. Preliminary Exam Waiver form (Plan I). | | Preliminary Exam Waiver (see FORMS) |
| Submit five copies of final signed thesis ready for binding to the Graduate School (Plan I). | Approximately the tenth week of the semester in which the degree is expected. See Graduate School Calendar for date. | |
| Pay thesis binding and graduation fee (Plan I). | At least two weeks before Commencement. | |
| Participate in commencement (optional). | See Graduate School calendar for exact date. | |

DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

The Doctor of Philosophy (Ph.D.) degree in Mechanical Engineering at UAHuntsville is a research-oriented degree awarded upon completion of a defined Program of Study, demonstration of scholarly competence, distinctive achievement in a special field, and demonstrated ability to do an independent, original investigation. Demonstration of substantial scholarly research accomplishments, rather than mere accumulation of residence and course credits, is an essential consideration in awarding the Ph.D. degree.

In addition to required coursework, a PhD student must pass three examinations before being awarded the degree; the Preliminary Examination, the Qualifying Examination, and the Final Comprehensive Examination. Specific details on each examination are provided in the section entitled **EXAMINATIONS**. A student is officially admitted to the Ph.D. Program only after satisfactorily passing the Preliminary Examination or with an approved exam waiver.

ADMISSION REQUIREMENTS

A Ph.D. candidate must be admitted to the School of Graduate Studies before being admitted to the Ph.D. program. Admission is limited to those whose background shows distinct promise of success in the program. Table 3 summarizes the requirements for admission to the UAHuntsville Ph.D. program for students with a MSE degree from UAHuntsville or from another graduate institution. Applicants are evaluated on the basis of their overall records. A minimum graduate grade point average of 3.00 is required before an application will be processed.

Table 3 – Ph.D. Program Admission Requirements

| Degree | Course Hours Accepted from MS Degree | Minimum Additional Course Hours for PhD | Preliminary Exam |
|-----------------------------|---|--|---|
| UAH MSE Plan I, Thesis | 33 (can include up to 9 hrs of MAE 699) | 15 | Preliminary Exam is waived based on GPA ≥ 3.5 AND recommendation of MSE Supervisory Committee |
| UAH MSE Plan II, Non-Thesis | 33 | 15 | Must take by semester after completion of 12 course hours, Score $\geq 60\%$ |
| UAH MS Plan II SE | 33 | 15 | Must take by semester after completion of 12 course hours, Score $\geq 60\%$ |
| Non-UAH MSE | 33 (can include up to 9 hrs of thesis credit, but excludes graduate seminar) | 15 | Must take by semester after completion of 12 course hours, Score $\geq 60\%$ |

PROGRAM OF STUDY

The Ph.D. Program of Study should exhibit both a breadth of understanding of engineering with a demonstrated depth in a focused area of Aerospace or Mechanical Engineering. As shown in Table 4, the MAE Ph.D. Program of Study consists of a minimum of 67 course and research credit hours beyond the BSE degree. The course credit hour requirement for students with a MSE degree is a minimum of 48 semester hours, that is, a minimum of 15 semester hours beyond the MSE degree. Students entering the Ph.D. program without an MSE degree are required to first complete the requirements for an MSE degree (either with or without a thesis).

Table 4 – Ph.D. Program Requirements (67 hours minimum)

| Minimum Course Hours | Minimum Research Hours | Other | Exams |
|---|---|--|---------------------------------|
| 48 27 – major 12 – 1 st minor 9 - 2 nd minor | 18 hrs of MAE 799; After passing Qualifying Exam, must enroll in 3 hrs each Fall/Spring semester until degree requirements completed. | 1 hr of MAE 683 unless taken during UAH MSE degree. | Preliminary Exam** Qualifier |

**** Candidates for the Ph.D. degree must take the Preliminary Exam by the semester after completing 12 hours of graduate course work at UAHuntsville or have a waiver approved by their MSE Supervisory Committee in their permanent file.**

The specific Program of Study is designed by the student, his/her advisor, and the supervisory Committee. The major area consists of a minimum of 27 semester hours of course work within MAE and related departments. A minimum of 12 semester hours of course work is required for the first minor and a minimum of 9 semester hours for the second. One of the minors must be in mathematics, which typically includes MAE 692 and MAE 693. Any Ph.D. candidate that did not take MAE 683 during their MSE degree at UAHuntsville must take MAE 683 (see **GRADUATE SEMINAR POLICY**).

CONTINUOUS REGISTRATION

All students who have completed the minimum coursework requirements for the Ph.D. degree and have passed the Qualifying Examination must register for a minimum of 3 semester hours of graduate credit (course or MAE 799 credit) **each** Fall and Spring semester until all degree requirements are complete.

GRADE REQUIREMENTS

All Ph.D. students must maintain a satisfactory academic standing to continue their degree program. Satisfactory standing includes the following:

- (1) Average grade on the courses numbered 600 and above cannot be less than B; and
- (2) A minimum grade of B must be attained in each engineering course in the student's Program of Study designated by a number less than 600. If a lower grade is attained, a substitution of another approved course is required.

The following additional policies are applied to 500 level courses:

- (1) Engineering courses numbered between 500-599 may be taken for graduate credit with prior approval of such courses on the student's Program of Study. Graduate students may be required to do extra work of appropriate nature in 500-level courses.
- (2) The number of 500 level course credit hours for the entire Ph.D. program (including MSE coursework) shall not exceed twelve (12).

TRANSFER CREDIT

Students entering with an accredited MSE degree may transfer up to 33 hours (including up to 9 hours of thesis credit) toward a Ph.D. degree. The number of additional credit hours that may be transferred from other accredited institutions is limited to 6 beyond an MSE degree. These additional hours must be in one of the following categories:

- (1) Graduate work completed elsewhere before admission to UAH and for which a degree was not awarded;
- (2) Graduate work completed elsewhere after admission to UAH and for which a degree was not awarded; or
- (3) Graduate work completed in the senior year at UAH that was not applied to the baccalaureate.

Additional rules governing transfer of credit are contained in the UAHuntsville Graduate Catalog. A student considering taking graduate work elsewhere during a leave of absence should consult his advisor about plans and any courses that may be offered for transfer. All courses approved for transfer must be recorded in the list of proposed courses on the Ph.D. Program of Study. The transfer of courses from another university **must** be approved through the School of Graduate Studies **before** submission of the proposed course list.

ACADEMIC RESIDENCE

For the award of a Ph.D. degree, residence at UAH as a graduate student is required for evaluation of the student's investigative abilities, independent thought, and scholastic progress by faculty members other than the major advisor. The residence requirement for the Ph.D. is at least one continuous academic year at UAHuntsville or at least 12 semester hours beyond the MSE at UAHuntsville. All research effort presented for residence credit toward the Ph.D. degree must be performed under the direction of a permanent member of the faculty.

DISSERTATION

The dissertation is evidence that the student can independently identify a problem of contemporary significance through familiarity with the current literature in the major field, organize and execute a program of research, recognize and analyze the results, and present them in a cogent exposition written in fluent, acceptable English. Dissertation results are expected to be submitted for refereed scholarly publication. All dissertations are expected to be accessible to the general public. Students must register for a minimum of 18 semester hours of dissertation during the time they are actively conducting research and consulting their dissertation advisor. These hours can also be used to count toward the continuous registration requirement.

A completed copy of the dissertation must be submitted to the MAE Department at least eight weeks before the end of the semester in which degree requirements are expected to be completed. Detailed procedures for submission of theses can be found at <http://grad.uah.edu>. After the student has passed his/her dissertation defense and at least five weeks before the end of the semester in which degree requirements are expected to be completed, a copy of the thesis signed by the Supervisory Committee, Department Chair and College Dean must be submitted to the Office of Graduate Studies for final proofreading and approval by the Graduate Dean. Six printed copies and one digital copy of the final approved thesis must be deposited in the Office of Graduate Studies along with applicable forms and fees one week prior to the end of the semester. Theses must comply with the regulations set forth in the Graduate School's *Thesis and Dissertation Manual*, available online at <http://grad.uah.edu/thesismanual.php>.

JOURNAL SUBMITTAL

Each Ph.D. student is required to derive a manuscript from their dissertation for consideration for publication as an article in an appropriate journal. The specific journal should be chosen in consultation with the advisor and Supervisory Committee. A draft of this manuscript must be submitted to the Supervisory Committee at the oral Final Examination. The final revised manuscript must be provided to the student's advisor when the final dissertation manuscript is submitted. The manuscript may be included as an appendix to the dissertation. The manuscript must be appropriately formatted as specified by the journal editors. If an article based on the dissertation research is previously accepted, it should be noted on the **Report of Oral Examination Committee** (see **FORMS**) and documented in an appendix of the dissertation.

SUPERVISORY COMMITTEE

A temporary faculty advisor appointed by the Department Chair directs the student's work until the Preliminary Examination is successfully completed. Thereafter the student immediately chooses a permanent advisor and a Supervisory Committee consisting of a Committee Chair (typically the advisor) and at least four additional members. The Chair and at least half of the Committee must:

- (1) Be full-time UAH faculty members; and
- (2) Have full membership in the graduate faculty.

The Supervisory Committee members are subject to approval of the Department Chair and the Graduate Dean. At least three of the committee members should represent the major field of study and one or more should be from the minor fields. Under the guidance of the faculty dissertation advisor, the student will be allowed to register for dissertation, MAE 799.

EXAMINATIONS

A student must pass three examinations before being awarded the Ph.D. degree. These are the Preliminary Exam, the Qualifying Exam, and the Final or Dissertation Exam.

Preliminary Examination

The Preliminary Examination is a written test of the student's capability to successfully pursue the Ph.D. Candidates for the Ph.D. degree must take the Preliminary Exam before completing no more than 12 hours of graduate course work at UAHuntsville or have a waiver approved by their

MSE Supervisory Committee in their permanent file. Failure to take the exam within the prescribed period will result in the student's admission to the Ph.D. program being voided.

The Preliminary Exam is administered in accordance with the procedure provided in the **MAE DEPARTMENT PRELIMINARY EXAM HANDBOOK**. The handbook also includes typical exam problems. A score of 60% or greater is required to pass. A student who fails this examination may repeat it for the second time. In extenuating circumstances a student may submit a petition to the MAE Department Chair with the signed concurrence of a faculty member, for a third attempt. The Graduate Program Committee will review this petition for approval or disapproval.

A waiver of the Preliminary Examination may be granted to students who completed their MSE in Mechanical, Aerospace or Chemical Engineering at UAHuntsville with a thesis option (Plan I) and a grade point average of 3.5 or above. The student's Supervisory Committee recommends the waiver by signing the **Preliminary Exam Waiver** (see **FORMS**) at the oral Final Exam for the MSE thesis. The request for waiver from the Preliminary Examination must be submitted to the Department Chair when the final thesis manuscript is submitted for review.

Qualifying Examination

The Qualifying Examination is a written and oral test of the student's knowledge in the major and minor fields of study and is administered by their advisor and Supervisory Committee within one year of the date he/she completes the formal coursework on the Program of Study. The student must be enrolled in Dissertation hours (MAE 799) in the semester he/she is scheduled to take the Qualifying Exam.

The Qualifying Exam is conducted in two distinct stages. The first stage is a demonstration through a *written* examination that the student is proficient in the subject matter in the Program of Study. The second stage is an *oral* review of the written exam and a dissertation proposal.

The closed book, written portion of the Qualifying Examination is approximately 4 hours in length and covers all courses in the major and minor areas. The major advisor is responsible for administering this examination. The advisor may, at his own discretion, solicit problems from the members of the Supervisory Committee and/or from any faculty members as deemed necessary. Acceptability of the written examination is determined solely by the major advisor or with the consultation of the members of the Supervisory Committee if so desired. The results of this examination should be made available to all members of the Supervisory Committee at the time of the oral review and will be retained as a permanent record in the student's file.

If the written portion of the exam is deemed acceptable by the major advisor, then the oral portion of the Qualifying Examination will be scheduled through the School of Graduate Studies by submitting the **NOTIFICATION OF ORAL EXAM/DEFENSE** (see **FORMS**) at least two weeks in advance. All members of the Advisory Committee shall participate in this oral examination. The student's performance on the written exam will be reviewed. Additional related questions may be asked to clarify the student's answers. The second portion of the oral exam is the dissertation proposal review in which the student makes an oral presentation

describing the proposed dissertation research. Both the dissertation topic and expected approach must be clearly delineated to the Supervisory Committee's satisfaction in order for a pass to be granted.

Once the oral review is complete, the results of the Qualifying Examination are reported to the School of Graduate Studies within two working days by submitting the **REPORT OF ORAL EXAMINATION COMMITTEE** (see **FORMS**). The presentation of the oral dissertation proposal may be given no more than twice.

Final Examination

The Final Examination or Dissertation Defense is an oral presentation of the dissertation in the form of a seminar before the student's Supervisory Committee and is open to the members of the University community. Approval of the dissertation by a majority of the Committee is required. Students cannot schedule their Final Examination unless they are in good academic standing. Ph.D. students must also be enrolled in dissertation hours (MAE 799) in the semester they defend and or graduate.

The examination must be given at least six weeks before the end of the semester in which degree requirements are expected to be completed, and the results reported within two working days to the Graduate Dean. The Graduate Dean appoints an additional member of the graduate faculty to act as observer for all dissertation defenses.

Once set, the examination becomes an official Graduate School matter and the date cannot be changed without prior arrangement amongst the Supervisory Committee members and the student and without approval of the Graduate Dean. For more details consult the *Graduate School Handbook*. A student may take the final examination no more than twice.

TIME LIMIT

All requirements for the Ph.D. degree must be completed in no more than five years after the student has passed the Qualifying Examination. Any deviation from this rule or time extension is subject to approval by the Graduate Program Committee with the recommendation of the advisor. An extension must also be approved by the Graduate Dean.

APPLICATION FOR DEGREE

Each candidate for a Ph.D. degree must apply for the degree by submitting the appropriate form and fee through Charger Central at least three months before it is to be conferred. Consult the Graduate Studies website for specific deadline dates.

Ph.D. DEGREE CHECKLIST

The checklist in Table 5 summarizes the steps to follow to ultimately attain a Ph.D. degree in the MAE Department. Note the dates indicated and the forms to be filed. The individual forms show the required approvals and number of copies needed or specified by the Department and Graduate Studies. Students should also refer to the section entitled **MASTER'S AND Ph.D. STUDENTS DATES & DEADLINES** for important dates and deadlines designated by the Graduate School.

If all requirements for the degree are completed during the current semester but the deadlines were not met, the student will not be required to register during the following semester in order to graduate during that semester.

Table 5 - Ph.D. Degree Checklist

| Step | Date / Deadline | Forms |
|---|---|--|
| Submit Application to UAHuntsville Graduate Studies | June 15 – Fall; October 15 – Spring; March 15 – Summer | http://www.uah.edu/gradschool/admissions.php |
| Fill out MAE Graduate Student Information Form | Return to MAE Department as soon as possible. | MAE Department Graduate Student Information (see FORMS) |
| Take Preliminary Exam or request waiver. (Score \geq 60% is passing) | <ul style="list-style-type: none"> ➤ Must be taken in the fall or spring semester after completion of 12 hours of graduate course work. ➤ Register for exam through MAE Department. | Report of Ph.D. Preliminary Examination http://www.uah.edu/gradschool/forms.php Preliminary Exam Waiver (see FORMS) |
| <ul style="list-style-type: none"> ➤ Select a permanent Advisor ➤ Form Supervisory Committee ➤ Submit a Plan of Study to the Graduate School | After passing Preliminary Exam | Program of Study for Doctoral Degree http://www.uah.edu/gradschool/forms.php |
| <ul style="list-style-type: none"> ➤ Select dissertation topic in consultation with Advisor ➤ Identify journal for manuscript submittal | As early as possible after passing Preliminary Exam | |
| Verify Program of Study or petition for PoS Change | | Change to Program of Study http://www.uah.edu/gradschool/forms.php |
| Schedule written portion of Qualifying Exam | Within one year after completing coursework on Program of Study | |
| Schedule oral portion of Qualifying Exam | Within one semester of passing written portion of Qualifying Exam and at least two weeks in advance. | Notification of Oral Examination/Defense http://www.uah.edu/gradschool/forms.php |

Table 5 - Ph.D. Degree Checklist, Continued

| Step | Date / Deadline | Forms |
|--|---|---|
| Advisor submits results of Qualifying Exam | Within two working days | Report of Oral Examination Committee http://www.uah.edu/gradschool/forms.php |
| Enroll in at least three hours of course credit or MAE 799 each Fall and Spring semester until degree requirements are complete. | After completing minimum coursework requirements and passing the Qualifying Examination | |
| Submit form to change Supervisory Committee membership (if needed) including valid reason for change. | At least one semester before Graduation. | Petition for Change in Graduate Supervisory Committee http://www.uah.edu/gradschool/forms.php |
| File Application for Advanced Degree | At least 3 months before Final Exam/Defense. | Application for Advanced Degree http://www.uah.edu/gradschool/forms.php |
| Schedule Final Oral Examination and provide dissertation draft to Supervisory Committee. | <ul style="list-style-type: none"> ➤ At least two weeks in advance of Exam. ➤ Exam must be taken at least six weeks before the end of the semester in which degree requirements will be completed. ➤ Must be enrolled in dissertation hours (MAE 799). | Notification of Oral Examination/Defense http://www.uah.edu/gradschool/forms.php |
| Prepare journal article manuscript in appropriate format. | <ul style="list-style-type: none"> ➤ Present draft manuscript to Supervisory Committee at oral dissertation defense. ➤ Submit final manuscript with final dissertation document. | |
| Advisor submits results of Final Oral Examination. | Within two working days after passing exam. | Report of Oral Examination Committee http://www.uah.edu/gradschool/forms.php |
| Submit five copies of final signed dissertation ready for binding to the Graduate School (Plan I). | Approximately the tenth week of the semester in which the degree is expected. See Graduate School Calendar for date. | |
| Pay thesis binding and graduation fee (Plan I). | At least two weeks before Commencement. | |
| Participate in commencement (optional). | See Graduate School calendar for exact date. | |

GRADUATE COURSE LISTING

MECHANICAL AND AEROSPACE ENGINEERING (MAE)

520 Compressible Aerodynamics Fluid Mechanics (3 hrs)

Principles of compressible flow including area change, friction and heat transfer. Fundamentals of acoustic waves, one and two-dimensional shock and expansion waves, shock-expansion theory, and linearized flow with application to inlets, nozzles, wind tunnels, and supersonic flow over aerodynamic bodies and wings. Prerequisites: MAE 310, 341 (Same as MAE 420/520).

530 Fundamentals of Aerodynamics (3 hrs)

Application of the principles of fluid mechanics and thermodynamics to the prediction of aerodynamic performance of aircraft, missiles and other flight vehicles. Topics include lift and drag, thrust and power, and the influence of wing loading, power loading, zero-lift drag, wing geometry, high lift devices Mach number, etc., on the performance and design trades of flight vehicles. Prerequisite: MAE 520 (Same as MAE 430).

531 Introduction to Plasma Dynamics (3 hrs)

Single particle motion in magnetic fields; fluid equations and fluid theory wave modes; MHD theory, stability, and wave modes; introduction to kinetic theory and hot plasma wave modes. Prerequisites: PH 421, 432 (Same as PH 531).

540 Rocket Propulsion I (3 hrs)

Introduction to the operation, analysis, and design of liquid and solid rockets. The course incorporates an experience in design and realization of a thermal system, in which students work in teams to design a rocket motor or component. Prerequisites: MAE 342, 520 (Same as MAE 440).

541 Airbreathing Propulsion (3 hrs)

Survey of airbreathing propulsion systems with special emphasis on gas turbine engines for aircraft and rotorcraft. Thermodynamic power cycles, design of components, and overall engine performance analysis. Discussion of practical design and operations considerations including engine controls, reliability, and durability. The course incorporates an experience in design and realization of a thermal system in which students work in teams to design a turbine engine. Prerequisites: MAE 342, 520 (Same as MAE 441).

542 Internal Combustion Engines (3 hrs)

Application of principles of thermodynamics, heat transfer, and fluid mechanics to combustion engines and turbines. Basic engine types, engine components, idealized cycles, combustion, fuels, engine variables, testing, exhaust gas analysis, and air pollution as related to spark-ignition, compression-ignition, and turbine engines. Prerequisites: MAE 342, 410, 450.

545 Heat Distribution System Design (3 hrs)

Design of hydronic and air distribution systems used in heating and air conditioning. Piping design, pump selection, heat coils, room air distribution, ducting design, fan selection, controls, and complete systems. Prerequisite: MAE 410; MAE 455 recommended.

546 Solar Energy Systems (3 hrs)

Components for solar-energy systems (collectors, heat exchangers, thermal storage). Numerical simulation of solar energy systems, and solar energy system design. Residential and commercial space heating, process heating, and hybrid system applications. Prerequisite: MAE 455; MAE 410 recommended.

548 Energy Conversion and Power Generation (3 hrs)

Application of principles of thermodynamics and fluid mechanics and economics to analysis and design of conventional hydro and steam power plants. Energy sources and end uses, fossil fuels, combustion equipment, steam generators, and pollution control devices. Hydro, steam and wind turbines. Prerequisites: MAE/CHE 352, MAE 442, 454; MAE 446 recommended.

561 Vibrations of Elastic Systems (3 hrs)

Formulation of the equations of motion of discrete and continuous systems, analytical and numerical methods of solution, eigenvalue problems, and dynamic response. Prerequisite: MAE 488 (Same as MAE 461).

563 Intermediate Dynamics (3 hrs)

Kinematics and dynamics of particles, system of particles, and rigid-bodies. Variational principles and Lagrangian mechanics. Prerequisite: MAE 272 (Same as MAE 463).

568 Elements of Spacecraft Design (3 hrs)

Fundamentals of spacecraft engineering and design. Topics include: orbital mechanics, space environment, attitude determination and control, communications, space structures, thermal control, propulsion and power, and systems and mission design. Prerequisites: MAE 272, 370, 450 (Same as MAE 468).

574 Applied Mechanics of Solids (3 hrs)

Stresses and strains at a point, theories of failures, stress concentration factors, thick-walled cylinders, torsion of noncircular members, curved beams, unsymmetrical bending, and shear center. Prerequisite: MAE 370 (Same as CE 474).

577 Experimental Techniques in Solid Mechanics (3 hrs)

Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems. Prerequisite: MAE 370 (Same as MAE 477).

580 Aircraft Stability and Control**(3 hrs)**

Stability and control of aerodynamic vehicles. Design of aircraft to obtain good flying characteristics. Complete governing equations and analog solutions of linearized equations. Prerequisites: MAE 420, 430, 488 (Same as MAE 480).

585 Numerical Methods and Engineering Computations III**(3 hrs)**

Advanced topics in numerical methods and engineering computation including: finite elements and finite differences in solving various engineering problems; Gaussian quadrature; interpolation, integration, and differentiation; and stability and convergence analysis of iterative methods. Numerical applications to fluid mechanics, heat transfer, structural mechanics, and machine design. Prerequisite: MAE 385 (Same as MAE 485).

589 Computer-Aided Engineering**(4 hrs)**

Application of computer methods in the analysis and design of structural, thermal, and dynamical systems. Use of state-of-the-art finite element and finite difference computer programs. Practical guidelines for discrete modeling and analysis of modeling errors. Comparison of exact and approximate solutions to boundary value problems. Use of microcomputers in engineering design and analysis. Prerequisite: MAE 370, 385 (Same as MAE 489).

595 Selected Topics in Mechanical & Aerospace Engineering (Credit to be arranged)

The following courses are open to graduate students only:

623 Computational Fluid Dynamics I**(3 hrs)**

Formulations by finite difference, finite element, finite volume, and spectral element methods for incompressible and compressible flows. Explicit and implicit methods, Von Neumann error analysis, consistency, convergence, and accuracy. Prerequisites: MAE 310, 385.

631 Rotorcraft Design I**(3 hrs)**

Conceptual design of rotorcraft systems with an emphasis on multi-disciplinary design. Comprehensive methodologies for vehicle synthesis and sizing including consideration of aerodynamics, propulsion, materials and structures, flight performance and control, and operations. Integration of advanced technologies. Rotorcraft Design I and II are the capstone design courses for the Aerospace MSE Program of Study in Rotorcraft Systems Engineering. Prerequisite: MAE 657.

632 Rotorcraft Design II**(3 hrs)**

Continuation of Rotorcraft Design I including higher fidelity simulations and trade studies. Consideration of maneuverability, structural dynamics, drive train and hub design, advanced flight control system design, sensors, weapons, component integration, and packaging, and life-cycle cost. Rotorcraft Design I and II are the capstone design courses for the Aerospace MSE Program of Study in Rotorcraft Systems Engineering. Prerequisite: MAE 631.

633 Tactical Missile Design I (3 hrs)

Conceptual design of missile systems with an emphasis on multi-disciplinary design. Comprehensive methodologies for vehicle synthesis and sizing including consideration of aerodynamics, propulsion, materials and structures, flight performance and control, and operations. Integration of advanced technologies. Tactical Missile Design I and II are the capstone design courses for the Aerospace MSE Program of Study in Missile Systems Engineering. Prerequisite with concurrency: MAE 755.

634 Tactical Missile Design II (3 hrs)

Continuation of Tactical Missile Design I including higher fidelity simulations and trade studies. Consideration of trajectory modeling and simulation, open-loop flight control system design, sensors, component integration and packaging, and life-cycle cost. Tactical Missile Design I and II are the capstone design courses for the Aerospace MSE program of study in Missile Systems Engineering. Prerequisite: MAE 633.

635 Aerospace Systems Engineering (3 hrs)

Introduction to Integrated Product and Process Development (IPPD) and life cycle analysis with application to Aerospace Systems. Systems engineering and quality engineering methods and tools. Top-down design decision support process. Computer integrated environment and robust design simulation will be addressed. Prerequisite: ISE 601, 690 or permission of instructor.

639 System Safety (3 hrs)

The process of system safety - from the creation and management of a safety program on a system under development, to the analysis that must be performed as this system is designed and produced to assure acceptable risk in its operation. Full discussion of the management and analysis processes and procedures. Incorporates the safety procedures used by the Department of Defense and NASA. Basic statistical methods and network analysis methods which provide an understanding of the engineering analysis methods that follow are covered. Prerequisite: ISE 638.

640 Rocket Propulsion II (3 hrs)

Aerothermodynamics of rocket propulsion systems; rocket propellants and combustion; heat transfer and cooling problems. Application to ramjets and hybrid systems. Prerequisite: MAE 540 or permission of instructor. Offered upon demand.

641 Advanced Thermodynamics (3 hrs)

Application of classical thermodynamics. Treatment of problems involving nonideal gases and liquids, phase equilibrium, and chemical equilibrium. Prerequisite: MAE 342 (Same as CHE 641).

643 Advanced Heat and Mass Transfer (3 hrs)

Continuation of MAE 450 in the study of conductive, convective, and radiative heat transfer and mass transfer. Emphasis is placed on heat transfer in turbulent flows and high speed flows, combined mode heat transfer, and mass transfer in reacting flows. Prerequisite: MAE 450.

645 Combustion I**(3 hrs)**

Combustion chemistry, introduction to mass transfer, chemical kinetics, reactors, simplified governing equations for chemically reacting flow, laminar diffusion and premixed flames. Prerequisite: Permission of instructor.

647 Uncertainty Analysis in Experimentation**(3 hrs)**

Uncertainty analysis concepts and techniques; application in planning, design, construction, debugging, execution, data analysis and reporting phases of experimental programs. Discussion of national and international standards and current engineering uncertainty analysis literature.

649 Transport Phenomena**(3 hrs)**

Mass, energy, and momentum transport in steady and transient motions in real and rheological substances. Prerequisite: MAE 450 (Same as CHE 649).

651 Viscous Fluid Mechanics**(3 hrs)**

Fundamentals of incompressible viscous fluid motion, including development of Navier Stokes equation. Exact and approximate solutions for both large and small Reynolds number. Laminar and turbulent boundary layers. Prerequisite: MAE 410.

657 Helicopter Theory**(3 hrs)**

Vertical flight, forward flight, performance, design, mathematics of rotating systems, rotary wing dynamics, rotary wing aerodynamics, helicopter aeroelasticity, stability and control, stall, and noise. Prerequisite: MAE 530 (was MAE 580).

658 Rotordynamics**(3 hrs)**

Torsional and transverse rotor vibration, critical speed and stability analysis, response to unbalance, rotor balancing. Rotordynamic phenomena including: gyroscopic effects, fluid film bearings, annular seals, stiffness asymmetry. Prerequisite: MAE 488 or permission of instructor.

660 Structural Dynamics**(3 hrs)**

Application of the theory of vibrations to discrete and continuous models of structures. Numerical methods of analysis for both spatial and temporal variables. Modal synthesis and step-by-step time integration methods. Finite element applications; substructuring techniques. Prerequisite: MAE 561 (Same as CE 661).

661 Advanced Dynamics**(3 hrs)**

Variational methods, optimization, and dynamic stability. Lagrangian and Hamiltonian formulation for dynamical systems and Hamilton-Jacobi methods to orbital mechanics. Prerequisite: MAE 563.

662 Nonlinear Dynamics and Chaos**(3 hrs)**

Nonlinear and chaotic dynamical systems, phase plane, periodic and strange attractors, stability analysis, critical points, Poincaré exponents, bifurcation points, solitons, logistic maps, Poincaré and Henon iterative maps, fractals, Mandelbrot and Julia sets, chaos in complex dynamical systems. Prerequisites: MA 244, 238.

663 Astrodynamics**(3 hrs)**

Astronomical coordinates and time systems; the many-body problems and disturbing functions. General perturbation methods, and application of classical mechanics and Hamilton-Jacobi methods to orbital mechanics. Prerequisite: MAE 563.

671 Continuum Mechanics**(3 hrs)**

Kinematics and kinetics, various coordinate systems, constitutive equations for continuous media; governing partial differential equations from first and second laws of thermodynamics; applications to solids, liquids, and gases. Prerequisites: MAE 310, 370 (Same as CE 671).

672 Elasticity**(3 hrs)**

Formulation of boundary-value problems of classical elasticity. Application to plane problems, prismatic members, and axisymmetric problems. Introduction to three-dimensional problems. Prerequisite: MAE 671 (Same as CE 672).

673 Plasticity**(3 hrs)**

Fundamentals of mechanical behavior of metals and nonmetals for stress states greater than the yield stress state. Deformation and flow theories. Stress-strain relations and yield criteria. Solution of boundary value problems with plastic bodies. Limit analysis of structures. Prerequisite: MAE 671 (Same as CE 673).

674 Finite Element Analysis I**(3 hrs)**

Finite element theory, variational methods, weighted residuals; applications to linear partial differential equations in continuous media; solution of boundary-value and initial-value problems. Prerequisite: MAE 671 (Same as CE 674).

676 Viscoelasticity**(3 hrs)**

Mechanical behavior of materials having time-dependent and temperature-dependent material properties. Creep and relaxation phenomena. Elastic-viscoelastic analogies. Formulation of stress-strain laws. Solution of boundary value problems for viscoelastic bodies. Prerequisite: MAE 671 (Same as CE 676).

677 Optical Techniques in Solid Mechanics**(3 hrs)**

Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-destructive, laser-based testing methods, fiber optic recording systems, photoelectronic-numerical data acquisition, and computer aided analysis. Prerequisite: MAE 577 or permission of instructor (Same as CE 677).

678 Mechanics of Composite Materials**(3 hrs)**

Introduction to composite materials, micro- and macro-mechanical behavior of laminae; bending, buckling and vibration of laminated plates. Prerequisites: MAE 671, 672 (Same as CE 678).

680 Performance Flight Testing (3 hrs)

Fundamentals of rotorcraft test and evaluation. Topics include: test planning, requirements analysis, helicopter performance evaluation, fundamentals of propulsion testing, aviation safety, use of modeling and simulation in flight testing, Department of Defense and Federal Aviation Administration requirements and procedures. Prerequisite: MAE 580, 657.

683 Graduate Seminar (1 hr)

Professional activities designed to promote the skills required to organize and deliver oral technical presentations and to broaden the individual's awareness of technical issues. Students will be graded "S" (satisfactory) or "U" (unsatisfactory) based upon their performance and attendance. Students who do not receive an "S" grade must register for the course until an "S" is obtained. (Same as CE 683).

684 Aerospace Systems Seminar (0 hrs)

Seminar course for students in the Aerospace MSE Program of Study in Rotorcraft Systems Engineering or Missile Systems Engineering. Students participate in seminars on specific aspects of rotorcraft and missile systems engineering including system integration, modeling and simulation, operations, and advanced technologies. Prerequisite: Graduate Standing.

692 Graduate Engineering Analysis I (3 hrs)

Ordinary differential equations (ODEs), Bessel functions, Legendre polynomials, Laplace transformations, simultaneous differential equations, application of ODEs to mechanical systems, partial differential equations (PDEs) and boundary-value problems, application of PDEs to mechanical systems. Prerequisite: MA 238.

693 Graduate Engineering Analysis II (3 hrs)

Fourier series and integrals, linear algebra, vectors, vector analysis and integral theorems, introduction to tensor analysis, analytical functions of a complex variable, Taylor and Laurent expansions, the residue theorem, stability criteria, and Calculus of Variations. Prerequisite: MA 238.

695 Selected Topics in Mechanical & Aerospace Engineering (Credit to be arranged.)

699 Master's Thesis (1, 3, 6, or 9 hrs)

Required each semester in which a student is working and receiving direction on a master's thesis. Minimum of two semesters and 6 hours required for M.S.E. students. A maximum of 9 hours of credit toward Ph.D. requirements is awarded upon successful completion of master's. The 1 hour option is only available to students who have successfully defended their thesis and submitted it for approval, but do not meet the deadlines for graduation in the semester submitted. Students may only use the 1 hour option once in their career. Prerequisites: Requires thesis advisor permission.

723 Computational Fluid Dynamics II (3 hrs)

Continuation of Computational Fluid Dynamics I, advanced topics in finite difference, finite element, finite volume, and spectral element methods. Prerequisite: MAE 623.

724 Computational Fluid Dynamics III (3 hrs)

Grid generation techniques with structured and unstructured meshes, adaptive meshes, domain decompositions, and parallel processing, Applications of generated meshes to any one of the following problems: turbulence, combustion, acoustics, radiation, multiphase flows, or magnetohydrodynamics. Prerequisite: MAE 723.

726 Rotorcraft Computational Fluid Dynamics (3 hrs)

Full potential, Euler, Navier-Stokes approaches structural and unstructured grids, wake capturing, turbulence, and acoustics. Prerequisite: MAE 651 or permission of instructor.

740 Aerothermodynamics (3 hrs)

Description of the dynamic and thermal fluid flow environments associated with hypervelocity vehicles and propulsion systems with emphasis on thermochemical nonequilibrium behavior. Topics include thermostistical basis for internal energies, specific heats and shock strengths in dissociated and ionized gases; formulation of reacting flow conservation equations; and recent experimental advances in aerothermodynamics. Prerequisite: MAE 520.

741 Statistical Thermodynamics (3 hrs)

Statistical ensembles; Maxwell-Boltzmann, Bose, Einstein, and Fermi-Dirac statistics. Application of statistical mechanics to thermodynamic processes. Information theory and its formalism. Prerequisite: MAE 641.

745 Combustion II (3 hrs)

Droplet evaporation and burning, introduction to turbulent flow, turbulent diffusion and premixed flames, burning of solids, pollutant emissions, and detonation. Prerequisite: MAE 645.

746 Convective Heat Transfer (3 hrs)

Advanced theory of convective transport processes in fluids, including transport of momentum and energy in laminar flow, boundary layers and turbulent transport in shear flow. Engineering applications include boiling and two phase processes. Prerequisite: MAE 643.

748 Radiative Transfer (3 hrs)

Physics and modeling of radiative transfer. Scattering, remote sensing, and absorption in participating media. Infrared through optical wave lengths. Computational methods in radiative transfer. Prerequisite: Permission of instructor.

749 Mass Transport (3 hrs)

Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems. Prerequisites: MAE 643, 651 (Same as CHE 749).

752 Mechanics of Rarefied Gases (3 hrs)

Application of kinetic theory to rarefied gas-flow problems. Boltzmann statistical distribution; gas-surface interaction, transport properties, free molecule flow; heat-free molecule flow; procedures for non-equilibrium flows. Prerequisite: MAE 651. Offered upon demand.

- 753 Magneto-Gas Dynamics** (3 hrs)
Equations of motion for ionized gases with critical analysis of transport properties in steady and varying electric and magnetic fields. MHD shock waves and radiation effects. Prerequisite: MAE 520.
- 754 Hypersonic Flow** (3 hrs)
Theories for treating the laminar and turbulent boundary layers of reacting fluids, mixtures, related chemical, thermodynamic, and physical phenomena in hypersonic flows. Leading edge bluntness, shock wave interactions, and vorticity effects. Prerequisite: MAE 520.
- 755 Advanced Aerodynamics** (3 hrs)
Transonic, supersonic, and hypersonic flows. Application of compressible potential theory, similarity rules, slender body theory and Newtonian flow theory to the analysis of aerodynamics of aircraft, missiles, re-entry vehicles, and other flight vehicles. Prerequisite: MAE 520, 530, or approval of instructor.
- 756 Numerical Simulations of Magneto-hydrodynamics** (3 hrs)
Finite difference methods for simulation of MHD flows. Methods include explicit scheme, FICE methods, LBL, ADI, artificial damping and projected characteristics for multidimensional time-dependent flow. Prerequisite: MAE 753.
- 757 Optical Techniques in Fluid Mechanics** (3 hrs)
Laser sources, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics. Prerequisites: EE 542 (Same as CHE 757).
- 758 Turbulence** (3 hrs)
Turbulence in gases and liquids; boundary layers, atmospheric phenomena. Prerequisite: MAE 651, 671.
- 760 Analytical Methods in Nonlinear Dynamics** (3 hrs)
Application of averaging methods and perturbation methods to vibrations of nonlinear systems. Analysis of linear systems with periodic coefficients (Floquet theory). Elements of stability theory, Liapunov functions, and Liapunov's direct method. Prerequisite: MAE 660, 661.
- 762 Wave Motion of Continuous Elastic Bodies** (3 hrs)
Elements of stress wave propagation in bounded elastic media. Propagation of elastic waves in infinite and semi-infinite bodies, cylinders, rods and beams. Prerequisite: MAE 660 (Same as CE 762).

765 Random Vibration of Elastic Systems**(3 hrs)**

Dynamic analysis of elastic systems including the response of complex structures to random excitations. Typical excitations include random wind, thermal, earthquake, aerodynamic, and ocean wave phenomena. Probabilistic mechanics methods. Concepts of reliability. Stationary and ergodic processes. Prerequisite: MAE 561 (Same as CE 765).

768 Dynamics of Aerospace Vehicles**(3 hrs)**

Elements of advanced rotational kinematics of rigid bodies. Attitude motion of space vehicles in circular and elliptic orbits. Methods of gravitation and spin stabilization of gyrostats. Prerequisites: MAE 660 or 661.

772 Theory of Structural Stability**(3 hrs)**

Energy criterion for stability of elastic structure under conservative loading. Stability concept for general continuous systems. Rigorous and approximate methods of analysis. Buckling of structural elements under impulsive and nonconservative loading. Postbuckling behavior. Prerequisite: MAE 671 (Same as CE 772).

773 Theory of Shells**(3 hrs)**

Analysis of thin plates and shells including higher order approximation theories and transverse-shear deformations. Illustration of theories by selected problems. Prerequisite: MAE 671 (Same as CE 773).

774 Finite Element Analysis II**(3 hrs)**

Advanced topics in finite element analysis; application to nonlinear partial differential equations in continuum mechanics; theoretical studies of convergence and stability of solutions. Prerequisite: MAE 674 (Same as CE 774).

776 Theory of Finite Elasticity and Finite Viscoelasticity**(3 hrs)**

Theory of finite deformation analysis for elastic and viscoelastic materials. Constitutive models are developed for a functional analysis approach leading to models based on the Cauchy-Green Deformation Tensor and the Strain Energy Density Function. Models discussed include: Mooney-Rivlin and Bernstein-Kearsley-Zappas. Prerequisite: MAE 671.

778 Fracture Mechanics**(3 hrs)**

Theory of crack propagation, stress intensity factors, mapping techniques, series expansion, asymptotic approximations, field singularities, integral transforms, numerical solutions. Prerequisite: MAE 672 (Same as CE 778).

780 Theory of Acoustics**(3 hrs)**

Simple harmonic oscillators, damped and forced oscillators, 1-D wave equation, vibration of a string, 2-D wave equation, vibration of membranes, the acoustic wave equation, plane waves, cylindrical and spherical waves, reflection and transmission, radiation and reception of acoustic waves, absorption and attenuation of sound, cavities and wave guides, and architectural acoustics. Prerequisites: MAE 692,

781 Nonlinear Effects in Plasma (3 hrs)

Fundamental physical concepts and methods of estimating various nonlinear interactions in plasmas. Analytical and numerical methods to deal with these problems. Prerequisite: PH 531 or permission of instructor.

782 Plasma Turbulence (3 hrs)

Methodology that deals with plasma turbulence together with current numerical techniques to solve these problems approximately, via super-computing. Prerequisite: PH 531 or permission of instructor.

795 Selected Topics in Mechanical & Aerospace Engineering Credit to be arranged

799 Doctoral Dissertation (3, 6, or 9 hrs)

Required each semester student is enrolled and receiving direction on doctoral dissertation. Prerequisite: Permission of dissertation advisor.

CHEMICAL ENGINEERING (CHE)

540 Physical Properties of Fluids (3 hrs)

Theoretical, experimental, and correlation methods for determining and predicting the thermodynamic and transport properties of various fluids. Critical properties, equations of state, vapor pressure and latent heat, heat capacity. Viscosity, thermal conductivity, diffusion coefficient, phase equilibrium, heat and free energy for formation. Prerequisite: CHE 342. Offered upon demand.

541 Chemical Kinetics And Reactor Design (3 hrs)

Fundamental principles of chemical kinetics and chemical reactor engineering along with the design of both thermal and catalytic reactors. Prerequisites: CHE 344, 443.

549 Introduction To Environmental Engineering (3 hrs)

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses; industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control. Prerequisite: CHE 442. (Same as CE 549.)

550 Environmental Control (3 hrs)

Engineering design and synthesis of environmental control systems. Control of multi-phase systems with application to air and water pollution control. Prerequisite: MAE/CHE 442 (Same as CE 550).

559 Selected Topics in Chemical Engineering (Credit to be arranged)

560 Introduction to Bioprocess Engineering (3 hrs)

Application of engineering principles to the analysis of and the development and design of processing using biological catalysts including enzymes, plant and animal cells, and genetically engineered cells. Other topics include fermentation and biological mass transport processes.

Prerequisites: CH 362 and 363.

561 Bioseparations, Recombinant Techniques And Protein Engineering (3 hrs)

General characteristics of separation processes used in the biotechnology industry including removal of insolubles, isolation and purification of thermally sensitive products for final use by the customer. Application of unit operation principles for biological separations, recombinant DNA techniques and protein engineering. Prerequisites: CH 362 and 363, CHE 560.

570 Mechanical Behavior of Engineering Materials (3 hrs)

Structure, properties, and behavior of materials. Structural defects and their influence on mechanical properties, point defects, dislocation and lattice imperfection in crystals, elastic deformation of single crystal and polycrystalline alloys, strengthening mechanisms and fracture. Strain rate, time to failure, and cyclic life from a microscopic viewpoint. Prerequisites: CHE 294, CE 370.

594 Applied Materials Engineering (3 hrs)

Synthesis and processing methods of materials for engineering applications. Selection and use of material performance factors for design of structural and functional components. Use of computational methods in solving open-ended design problems that depend on an understanding of the nature and properties of materials will be emphasized. All classes of materials are covered. Prerequisites: CHE 344 and either CH 342 or 348.

595 Polymer Engineering (3 hrs)

Engineering principles of polymers and their role in manufacturing processes. Aspects of polymer phenomena and their relationship to processing of structural and functional components. Prerequisites: CH 341 and 440.

595 Polymer Engineering (3 hrs)

Application of classical thermodynamics. Treatment of problems involving nonideal gases and liquids, phase equilibrium, and chemical equilibrium. Prerequisite: CHE 344 (Same as MAE 641).

644 Introduction To Electrochemical Systems (3 hrs)

Thermodynamics, transport, and kinetics of electrodes and cells. Systems analysis of batteries, fuel cells, porous electrodes, electroplating, electrowinning, and corrosion processes. Convective diffusion at high Schmidt numbers. Prerequisites: CHE 443 or equivalent.

646 Thermodynamics Of Materials (3 hrs)

Treatment of thermodynamic topics as they apply to behaviors observed in metallic and non-metallic materials. Prerequisites: CH 341 or equivalent.

649 Transport Phenomenon (3 hrs)
Mass, energy, and momentum transport in steady and transient motions in real and rheological substances. Prerequisite: CHE 442 (Same as MAE 649).

652 Introduction To Air Pollution (3 hrs)
Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution. Prerequisite: graduate standing. Offered upon demand. (Same as CE 652.)

654 Multiphase Transport And Particulate Phenomena (3 hrs)
Fundamental principles of gas-liquid/gas solid flows, particle size analysis particle/droplet dispersion, pneumatic transfer, adhesion and agglomeration atomization and spray, jump conditions at interface, numerical solutions. Prerequisite: CHE/MAE 649.

657 Advanced Process Control (3 hrs)
Application of modern control theory to chemical processes; multivariable control; estimation and adaptive control, optimal control. Prerequisite: CHE 445 or ECE 505.

658 Catalysis And Reactor Design (3 hrs)
Treatment of homogeneous and heterogeneous reaction kinetics, transport in fluid-solid reactions, catalyst deactivation and their effects on the analysis and design of chemical reactors. Prerequisites: CHE 541.

659 Selected Topics In Chemical Engineering (Credit to be arranged)

699 MASTER'S THESIS (3 or 6 hrs)
Required each term in which student is working and receiving direction on the Master's thesis. A minimum of two terms and six hours is required for M.S.E. students. A maximum of nine hours of credit is awarded upon successful completion of Master's thesis.

747 Advanced Topics In Bioengineering (3 hrs)
Engineering aspects of microbial processes and the processing of biological materials. Integrating knowledge of governing biological properties and principles with chemical engineering methodology. Emphasis on current literature in the areas of purification and separation technology, bioprocess development and biomaterials. Prerequisite: B.S. in chemical engineering or permission of the instructor.

749 Mass Transport (3 hrs)
Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems. Prerequisites: MAE 643, 651 (Same as MAE 749).

757 Optical Techniques In Fluid Mechanics

(3 hrs)

Laser courses, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics.
Prerequisites: EE 542 (Same as MAE 757)

799 Doctoral Dissertation

(3 or 6 hrs)

BASIC GRADUATE COURSES GROUPED BY DISCIPLINE

ROTORCRAFT AND MISSILE SYSTEMS ENGINEERING PROGRAMS

The UAHuntsville MAE Department offers two specialized Aerospace MSE Programs of Study in Rotorcraft Systems Engineering and Missile Systems Engineering. Students selecting one of these Plan II SE programs must follow the specific curricula shown below.

ROTORCRAFT SYSTEMS ENGINEERING (Landrum, Slegers, Snider)

| | | |
|-----|-----|---|
| MAE | 530 | Fundamentals of Aerodynamics |
| MAE | 541 | Airbreathing Propulsion |
| MAE | 580 | Aircraft Stability & Control |
| MAE | 631 | Rotorcraft Design I |
| MAE | 632 | Rotorcraft Design II |
| MAE | 657 | Helicopter Theory |
| MAE | 680 | Performance Flight Testing |
| MAE | 684 | Aerospace Systems Seminar (0 credit hours) |
| MAE | 692 | Graduate Engineering Analysis |
| ISE | 526 | Design of Experiments |
| ISE | 601 | Intro to Probability and Statistics for Engineers |
| ISE | 638 | Reliability Engineering |
| ISE | 547 | Introduction to System Simulation* |
| ISE | 637 | Systems Modeling and Analysis* |

*Choose between ISE 547 and ISE 637 as an elective

MISSILE SYSTEMS (Frederick, Landrum, Slegers, Snider)

| | | |
|-----|-----|---|
| MAE | 530 | Fundamentals of Aerodynamics |
| MAE | 540 | Rocket Propulsion I |
| MAE | 580 | Aircraft Stability & Control |
| MAE | 633 | Tactical Missile Design I |
| MAE | 634 | Tactical Missile Design II |
| MAE | 681 | Missile Trajectory Analysis |
| MAE | 684 | Aerospace Systems Seminar |
| MAE | 692 | Graduate Engineering Analysis I |
| MAE | 755 | Advanced Aerodynamics |
| ISE | 526 | Design of Experiments |
| ISE | 601 | Intro to Probability and Statistics for Engineers |
| ISE | 638 | Reliability Engineering |
| ISE | 547 | Introduction to System Simulation* |
| ISE | 637 | Systems Modeling and Analysis* |

*Choose between ISE 547 and ISE 637 as an elective

OTHER PROGRAMS OF STUDY

All MSE Plan I and Plan II (Non-thesis) students must take MAE 671 as part of their graduate program. All MSE students must have a 6 hour Math minor. MAE 671 can be applied toward 3 of the 6 hours. Courses in each major area indicated by ** are required for Plan II (Non-thesis) MSE students.

AERODYNAMICS (Cassibry, Landrum, Richardson)

| | | |
|-----|-----|----------------------------------|
| MAE | 520 | Compressible Fluid Mechanics** |
| MAE | 530 | Fundamentals of Aerodynamics** |
| MAE | 580 | Aircraft Stability and Control** |
| MAE | 651 | Viscous Fluid Mechanics** |
| MAE | 657 | Helicopter Theory |
| MAE | 754 | Hypersonic Flow |
| MAE | 755 | Advanced Aerodynamics |
| MAE | 758 | Turbulence |
| MAE | 780 | Theory of Acoustics |

MATERIALS AND SOLID MECHANICS (Evans, Gilbert, Karbhari, Lin, Zuo)

| | | |
|--------|-----|--|
| MAE/CE | 574 | Applied Mechanics of Solids |
| MAE/CE | 577 | Fundamentals of Experimental Mechanics |
| MAE/CE | 671 | Continuum Mechanics |
| MAE/CE | 672 | Elasticity |
| MAE/CE | 673 | Plasticity |
| MAE/CE | 676 | Viscoelasticity |
| MAE/CE | 677 | Optical Techniques in Solid Mechanics |
| MAE/CE | 678 | Mechanics of Composite Materials |
| MAE/CE | 772 | Theory of Structural Stability |
| MAE/CE | 773 | Theory of Shells |
| MAE/CE | 778 | Fracture Mechanics |

DYNAMICS AND VIBRATION (Lin, Slegers, Wallace)

| | | |
|--------|-----|--|
| MAE/CE | 561 | Vibration of Elastic Systems |
| MAE | 563 | Intermediate Dynamics |
| MAE/CE | 660 | Structural Dynamics |
| MAE | 661 | Advanced Dynamics |
| MAE | 663 | Astroynamics |
| MAE | 760 | Analytical Methods in Nonlinear Dynamics |
| MAE/CE | 762 | Wave Motion of Continuous Elastic Bodies |
| MAE/CE | 765 | Random Vibration of Elastic Systems |
| MAE | 768 | Dynamics of Aerospace Vehicles |

STRUCTURAL ANALYSIS (Evans, Gilbert, Lin, Zuo)

| | | |
|--------|-----|----------------------------------|
| MAE/CE | 660 | Structural Dynamics |
| MAE | 661 | Advanced Dynamics |
| MAE/CE | 671 | Continuum Mechanics |
| MAE/CE | 674 | Finite Element Analysis I |
| MAE | 678 | Mechanics of Composite Materials |

STABILITY AND CONTROL (Slegers)

| | | |
|--------|-----|---|
| ECE | 505 | Introduction to Control and Robotic Systems |
| MAE | 580 | Aircraft Stability and Control |
| ECE | 605 | Classical Control Design |
| CHE | 657 | Advanced Process Control |
| ECE | 701 | Advanced Linear Control Theory |
| ECE | 704 | Nonlinear Control Systems |
| ECE | 705 | Theory of Optimal Control |
| MAE/CE | 772 | Theory of Structural Stability |

FLUID MECHANICS (Bardot, Cassibry, Chung, Coleman, Freni, Landrum, Moser, Richardson, Shotorban, Wu)

| | | |
|--------|-----|---|
| MAE | 520 | Compressible Fluid Mechanics |
| MAE | 531 | Introduction to Plasma Dynamics |
| CHE | 540 | Physical Properties of Fluids |
| CHE/CE | 549 | Introduction to Environmental Engineering |
| MAE | 651 | Viscous Fluid Mechanics |
| CHE/CE | 652 | Introduction to Air Pollution |
| MAE | 623 | Computational Fluid Dynamics I |
| CHE | 658 | Catalysis and Reactor Design |
| MAE/CE | 671 | Continuum Mechanics |
| MAE | 723 | Computational Fluid Dynamics II |
| MAE | 724 | Computational Fluid Dynamics III |
| MAE | 751 | Boundary Layer Theory |
| MAE | 752 | Mechanics of Rarified Gases |
| MAE | 753 | Magneto-gas Dynamics |
| MAE | 754 | Hypersonic Flow |
| MAE | 755 | Advanced Aerodynamics |
| MAE | 758 | Turbulence |
| MAE | 780 | Theory of Acoustics |
| MAE | 781 | Nonlinear Effects in Plasma |
| MAE | 782 | Plasma Turbulence |
| PH | 531 | Introduction to Plasma Dynamics |

HEAT TRANSFER AND THERMODYNAMICS (Bardot, Blackmon, Cassibry, Chung, Richardson, Wessling, Wu)

| | | |
|---------|-----|---|
| CHE | 541 | Chemical Kinematics and Reactor Design |
| MAE | 545 | Heat Distribution Systems Design |
| MAE | 546 | Solar Energy Systems |
| MAE | 548 | Energy Conversion and Power Generation |
| CHE/CE | 549 | Introduction to Environmental Engineering |
| MAE/CHE | 641 | Advanced Thermodynamics |
| MAE | 643 | Advanced Heat and Mass Transfer |
| CHE | 644 | Introduction to Electrochemical Systems |
| CHE | 646 | Thermodynamics of Materials |
| MAE/CHE | 649 | Transport Phenomena |
| CHE | 657 | Advanced Process Control |
| CHE | 658 | Catalysis and Reactor Design |
| MAE | 740 | Aerothermodynamics |
| MAE | 741 | Statistical Thermodynamics |
| MAE | 746 | Convective Heat Transfer |
| MAE | 748 | Radiative Transfer |
| MAE/CHE | 749 | Mass Transport |

PROPULSION AND COMBUSTION (Blackmon, Cassibry, Frederick, Frendi, Landrum, Moser, Shotorban)

| | | |
|--------|-----|------------------------------|
| MAE | 520 | Compressible Fluid Mechanics |
| MAE | 541 | Airbreathing Propulsion |
| MAE | 640 | Rocket Propulsion II |
| MAE | 651 | Viscous Fluid Mechanics |
| MAE/CE | 671 | Continuum Mechanics |
| MAE | 645 | Combustion I |
| MAE | 745 | Combustion II |

NUMERICAL METHODS AND ENGINEERING ANALYSIS (Bardot, Chung, Coleman, Frendi, Lin, Richardson, Shotorban, Wallace, Wu)

| | | |
|--------|-----|---|
| MAE | 585 | Numerical Methods and Engineering Computation III |
| MAE | 589 | Computer Aided Engineering |
| MAE | 623 | Computational Fluid Dynamics I |
| MAE | 647 | Uncertainty Analysis in Experimentation |
| MAE/CE | 671 | Continuum Mechanics |
| MAE/CE | 674 | Finite Element Analysis I |
| MAE | 692 | Graduate Engineering Analysis I |
| MAE | 693 | Graduate Engineering Analysis II |
| MAE | 723 | Computational Fluid Dynamics II |
| MAE | 724 | Computational Fluid Dynamics III |
| MAE | 774 | Finite Element Analysis II |

CHEMICAL (Banish, Cerro, Chen, Chittur, Smith, Taconi, Weimer, Williams)

| | | |
|-----|-----|--|
| CHE | 540 | Physical Properties of Fluids |
| CHE | 541 | Chemical Kinetics And Reactor Design |
| CHE | 549 | Introduction To Environmental Engineering |
| CHE | 550 | Environmental Control |
| CHE | 559 | Selected Topics in Chemical Engineering |
| CHE | 560 | Introduction to Bioprocess Engineering |
| CHE | 561 | Bioseparations, Recombinant Techniques And Protein Engineering |
| CHE | 570 | Mechanical Behavior of Engineering Materials |
| CHE | 594 | Applied Materials Engineering |
| CHE | 595 | Polymer Engineering |
| CHE | 595 | Polymer Engineering |
| CHE | 644 | Introduction To Electrochemical Systems |
| CHE | 646 | Thermodynamics Of Materials |
| CHE | 649 | Transport Phenomenon |
| CHE | 652 | Introduction To Air Pollution |
| CHE | 654 | Multiphase Transport And Particulate Phenomena |
| CHE | 657 | Advanced Process Control |
| CHE | 658 | Catalysis And Reactor Design |
| CHE | 659 | Selected Topics In Chemical Engineering |
| CHE | 747 | Advanced Topics In Bioengineering |
| CHE | 749 | Mass Transport |
| CHE | 757 | Optical Techniques In Fluid Mechanics |

MASTER'S AND Ph.D. STUDENTS DATES & DEADLINES

<http://www.uah.edu/gradschool/datesanddeadlines.pdf>

SPRING

| | |
|-----------------------------|------------|
| Application to Graduate: | February 1 |
| Oral Defense: | March 1 |
| Submission of Thesis: | March 15 |
| Submission of Dissertation: | April 1 |
| Non-Thesis Final Oral Exam: | April 15 |

SUMMER

| | |
|-----------------------------|---------|
| Application to Graduate: | June 1 |
| Oral Defense: | June 15 |
| Submission of Thesis: | June 30 |
| Submission of Dissertation: | June 30 |
| Non-Thesis Final Oral Exam: | July 15 |

FALL

| | |
|-----------------------------|-------------|
| Application to Graduate: | September 1 |
| Oral Defense: | October 15 |
| Submission of Thesis: | November 1 |
| Submission of Dissertation: | November 1 |
| Non-Thesis Final Oral Exam: | November 15 |

Thesis/Dissertation must be approved (signed) by committee, department/program chair, college dean and submitted to Graduate Studies by the POSTED date.

Dates falling on Saturday or Sunday will be extended to the following Monday

FORMS

Applications and Admissions

<http://www.uah.edu/gradschool/admissions.php>

MSE and Ph.D. program Admission

Non-degree Application

Programs of Study & Applications for Degree/Certificate

<http://www.uah.edu/gradschool/forms.php>

Program of Study for Masters Degree

Program of Study for Doctoral Degree

Change to Program of Study

Application for Advanced Degree

Examinations

<http://www.uah.edu/gradschool/forms.php>

Notification of Oral Exam/Defense

Report of Oral Examination Committee

Report of Ph.D. Preliminary Examination

Other

<http://www.uah.edu/gradschool/forms.php>

Change to Graduate Supervisory Committee

MAE Department Specific Forms

Graduate Student Information

Validation of Courses Beyond Six Year Limit

Certification of MSE Non-thesis Presentation

Preliminary Exam Waiver



Department of Mechanical & Aerospace Engineering
Graduate Student Information

We appreciate your application for graduate studies in Mechanical and Aerospace Engineering at UAH. In order to complete your application review, please fill in this form and return it by email to mae@uah.edu.

Contact Information:

Name _____ email _____
Phone _____ Starting Semester _____

Desired Degree and Major (check all that apply):

_____ MS w/thesis in _____ AE or _____ ME
_____ MS non-thesis in _____ AE or _____ ME
_____ MS Systems Engineering (SE) in _____ Rotorcraft or _____ Missiles
_____ PhD in _____ ME or _____ Chem Engr

Status: Will you be a _____ full-time or _____ part-time student?

Financial Support Desired (check all that apply):

_____ Research Assistantship (RA) _____ Teaching Assistantship (TA)

Technical Discipline (indicate first choice by 1 and, if applicable, second choice by 2):

_____ Materials & Solid Mechanics _____ Structural Analysis
_____ Dynamics and Vibrations _____ Stability and Control
_____ Fluid Mechanics _____ Aerodynamics
_____ Heat Transfer and Thermodynamics _____ Propulsion and Combustion
_____ Rotorcraft Systems Engineering _____ Missile Systems Engineering
_____ Numerical Methods & Analysis (includes CFD) _____ Other:

VALIDATION OF COURSES BEYOND SIX YEAR LIMIT

Department of Mechanical & Aerospace Engineering
The University of Alabama in Huntsville

Student Name: _____ A#: _____

| Course No. | Course title | Credit | Term | Faculty signature | Date validated |
|------------|--------------|--------|------|-------------------|----------------|
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| | | | | | |

The courses listed above have been validated in accordance with the policy of the Mechanical and Aerospace Engineering Department.

Graduate Program Committee Chair: _____ Date _____

(This is to be retained in the permanent student file)

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE
Department of Mechanical and Aerospace Engineering
CERTIFICATION OF MSE NON-THESIS PRESENTATION

The MAE Graduate Handbook requires all Plan II Non-thesis students to make an oral technical presentation in MAE 683 to satisfy requirements for their Final Comprehensive Examination.

TO: Chair, Mechanical and Aerospace Engineering

I confirm that:

(name) SID #
Department/Program

made an acceptable technical presentation on (date)

This examination was the first second attempt by the student.

Signature:
Name:

MAE 683 - Graduate Seminar Instructor

Form to be submitted to the Department of Mechanical and Aerospace Engineering.
Distribution: Department
Student

(This is to be retained in the permanent student file)

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE
Mechanical & Aerospace Engineering
Preliminary Exam Waiver
(Plan I, Thesis Option Only)

TO: MAE Department Chair

Name _____ SID # _____

Dept./Program: _____ Date: _____

- Masters Thesis Defense Passed
- GPA \geq 3.50
- Committee Recommends Ph.D. Preliminary Exam Waiver
- Committee Does Not Recommend Preliminary Exam Waiver

Signatures:

Committee Chair (type name here) Date

Advisor [if different from above] (type name here) Date

Member (type name here) Date

Member (type name here) Date